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other is on the surface outside the arc BEC is $S\div a^2\pi$. Hence the required probability is

$$P=\frac{2}{a^4\pi}\int_0^a Sxdx. \quad \text{Put}\, x=2a\sin\theta.$$

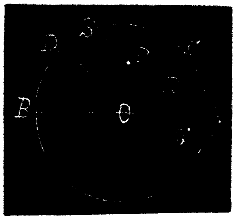
$$\text{Then}\ P=\frac{16}{\pi}\int_0^{\frac{1}{6}\pi}(\theta+\sin\theta\cos\theta)\sin\theta\cos\theta=3\sqrt{3}/4\pi.$$

III. **Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas.**

Let P, Q be the arrows, $SQ=x$, $PQ=y$, $ST=u$, $OR=z$, $\angle DOB=\theta$, $OA=a$.

An element of area at Q is $dzdx$; at P, $yd\theta dy$.

The limits of x and 0 are $u-a$; of y, $u-x$ and a, and doubled ; of z, 0 and $\frac{1}{2}a\sqrt{3}$, and doubled ; of θ, 0 and $\frac{1}{2}\pi$, and doubled. Δ=chance, $u=2\sqrt{a^2-z^2}$.



$$\therefore\ \Delta=\frac{8}{\pi^2a^4}\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}a\sqrt{3}}\int_0^{u-a}\int_a^{u-x}d\theta dzydxdy$$

$$=\frac{4}{\pi^2a^4}\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}a\sqrt{3}}\int_0^{u-a}\{(u-x)^2-a^2\}d\theta dzdx$$

$$=\frac{4}{3\pi^2a^4}\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}a\sqrt{3}}(u^3+2a^3-3a^2u)d\theta dz=\frac{3\sqrt{3}}{2\pi^2}\int_0^{\frac{1}{2}\pi}d\theta=\frac{3\sqrt{3}}{4\pi}.$$

MISCELLANEOUS.

Conducted by **J. M. COLAW**, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

34. **Proposed by THOS. U. TAYLOR, C. E., M. C.; Department of Engineering, University of Texas, Austin, Texas.**

Given a variable parallelogram $ABCP$, where P remains fixed. A moves on an irregular plane curve (closed) and C moves on another irregular plane curve (closed) whose plane is parallel to the plane of (A) curve. The generator PC moves completely around and returns to its initial position, AB always moving parallel to PC, and, of course, returns to its initial position. If distance between planes (A) and $(C)=h$, show by elementary mathematics and without using theorem of Koppe that volume of solid generated by variable parallelogram $ABCP=\frac{1}{2}h$ (area generated by AP+area generated by BC).

Solution by the PROPOSER.

Let (A)=area generated by PA ; (B)=area curve generated by B ; (C) =area curve generated by C.

Project area (A) orthogonally on plane of (B) and (C). Then by Elliott's Extension of Holditch's Theorem

$$S=x(A)+y(B)-xy(C).$$

where $x+y=1$, and x and y are the radii in which the section S divides the generator. Make $x=y=\frac{1}{2}$.

$$\therefore\ S_{\frac{1}{2}}=\tfrac{1}{2}(A)+\tfrac{1}{2}(B)-\tfrac{1}{4}(C).$$

But by Newton's formula, V=volume of whole solid

$$=\tfrac{1}{6}H\{(A)+4S_{\frac{1}{2}}+(B)\}=H\{\tfrac{1}{2}[(B)+(A)]-\tfrac{1}{6}(C)\}.$$

Volume of cone$=\frac{1}{3}H(C)$. $\therefore$ Volume generated by

$$APCB=\tfrac{1}{2}H\{(A)+[(B)-(C)]\}=\tfrac{1}{2}H\{\text{area } AP+\text{area } BC\}.$$

34. Proposed by WILLIAM SYMMONDS, A. M., Professor of Mathematics and Astronomy in Pacific College, Santa Rosa, California ; P. O., Sebastopol, California.

To an observer whose latitude is 40 degrees north, what is the sidereal time when Fomalhout and Antares have the same altitude: taking the Right Ascension and Declination of the former to be 22 hours, 52 minntes, —30 degrees, 12 minutes; of the latter, 16 hours, 23 minutes, —26 degrees, 12 minutes ?

II. Solution (continued) by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas.

$h=130^\circ\ 4'\ 57''$ for upper meridian.

$\therefore$ $180^\circ-130^\circ\ 4'\ 57''=49^\circ\ 55'\ 3''=h$, for lower meridian.

$\therefore$ h=3 hours, 19 minutes, 40.2 seconds.

$\therefore$ sidereal time for equal altitudes on latitude 40° south is $a-h$=19 hours, 32 minutes, 19.8 seconds.

$a-h-12=7$ hours, 32 minutes, 19.8 seconds is sidereal time on upper meridian at same moment.

Dr. S. Hart Wright communicated to me the following rather startling discovery which is probably responsible for the problem : The arc of a great circle passing to and between the two stars actually passed through the Nadir. Now when the stars are of equal altitudes they are equally distant from the Nadir as well as from the Zenith.

$\therefore$ The arc between them$=82^\circ\ 51'\ 52.5''$ must be bisected, each being $41^\circ\ 25'\ 56\frac{1}{4}''$.

These facts, if they had been stated, would have made the problem quite simple.

See problem and solution in August-September number.